

<b>COURSE TITLE</b>	<b>MATRIX ALGEBRA AND VECTOR SPACE</b>
<b>COURSE CODE</b>	<b>01MA0103</b>
<b>COURSE CREDITS</b>	<b>5</b>

**Objective:**

- 1 This subject aims to provide fundamentals of matrix algebra and vector calculus. The topics delivered in the paper are essential for engineering graduate-level courses.
- 2 This subject aims to provide fundamentals of matrix algebra and vector calculus. The topics delivered in the paper are essential for almost all science and engineering disciplines.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Employ vector analysis in multidimensional space for data and image interpretation.
- 2 Apply systems of linear equations to solve problems in engineering applications.
- 3 Employ eigenvalue and eigenvector techniques to analyze engineering problems.
- 4 Apply vector calculus methods to analyze gradient, divergence, and curl.

**Pre-requisite of course:** DIFFERENTIAL AND INTEGRAL CALCULUS

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	2	0	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Matrix Algebra - I</b> Definitions of some basic types of Matrices, Row Echelon form and Reduced Row Echelon form, Consistency of system of linear equations by Gauss Elimination and Gauss Jordan Method, Rank by row operation and determinant , Inverse of matrix by Gauss Jordan Method	9
2	<b>Matrix Algebra - II</b> Eigen values and Eigen vector of matrix, AM and GM of Matrix, Cayley-Hamilton theorem, Diagonalization, Orthogonally Diagonalization, Quadratic forms, Value class (Nature), Index and Signature of Quadratic form, Canonical forms	11
3	<b>Vector Space</b> Euclidean Vector Space, Vector space, Subspace, Linear Dependence and Independence of Vectors , Linear Combination, Span, Basis and dimension of vector space, Inner product spaces and their properties	11

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
4	<b>Vector Calculus</b> Recall the concept of vector algebra, Scalar and vector functions, gradient, Divergence and Curl, directional derivatives, Conservative vector fields, Irrotational and Solenoidal function, Line integrals, Path Independence of Line Integrals, Concept of surface integrals, Green's theorem, Stoke's theorem and Divergence theorem	9
5	<b>Improper Integrals</b> Improper integrals of type I and type – II, Convergence of Improper integrals	2
<b>Total Hours</b>		<b>42</b>

#### Suggested List of Experiments:

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Tutorial - 1 Matrix Algebra - I</b> Tutorial - 1 Matrix Algebra - I	4
2	<b>Tutorial - 2 Matrix Algebra - II</b> Tutorial - 2 Matrix Algebra - II	4
3	<b>Tutorial - 3 Vector Space</b> Tutorial - 3 Vector Space	4
4	<b>Tutorial - 4 Vector Calculus</b> Tutorial - 4 Vector Calculus	4
5	<b>Tutorial - 5 Improper Integrals</b> Tutorial - 5 Improper Integrals	2
6	<b>Tutorial - 6 Application of Linear Algebra by MATLAB</b> Introduction to MATLAB, some basic MATLAB command related to Matrices, , Row Echelon form and Reduced Row Echelon form, Rank of Matrix, Solution of system of, Linear equation, Inverse of Matrix, Characteristic polynomial of Matrix, Eigen value and, Eigen vector of Matrix, Power of Matrix.	10
<b>Total Hours</b>		<b>28</b>

#### Textbook :

- 1 Introduction to Linear Algebra with Application, Jim Defranza , Tata McGraw Hill., 2008
- 2 Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition., 2009

#### References:

- 1 Elementary Linear Algebra, Elementary Linear Algebra, Ron Larson, Cengage Learning, 2010
- 2 Linear Algebra and its Applications, Linear Algebra and its Applications, David C. Lay, Pearson Education, 2007
- 3 Linear Algebra: A first course with Applications in MATLAB, Linear Algebra: A first course with Applications in MATLAB, Larry E. Knop, CRC Press. Suggested, 2009

### References:

- 4 Advanced Engineering Mathematics, Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publication 10th ed, 2011
- 5 Higher Engineering Mathematics, Higher Engineering Mathematics, B.S.Grewal, Khanna publishers, 2012

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	20.00	30.00	15.00	10.00	5.00

### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

### Supplementary Resources:

- 1 [http:// mathworld.wolfram.com/](http://mathworld.wolfram.com/)
- 2 [http:// en.wikipedia.org/ wiki/ Math](http://en.wikipedia.org/wiki/Math)
- 3 [nptel.ac.in/courses/111108066/](http://nptel.ac.in/courses/111108066/)
- 4 <http://tutorial.math.lamar.edu/>